Advanced High-Strength Steel Technologies in the 2015 Ford Edge

John Reed

Ford Motor Company

Go Further

2015 Ford Edge

John Reed
North American Upper Body Applications Manager
Ford Motor Company

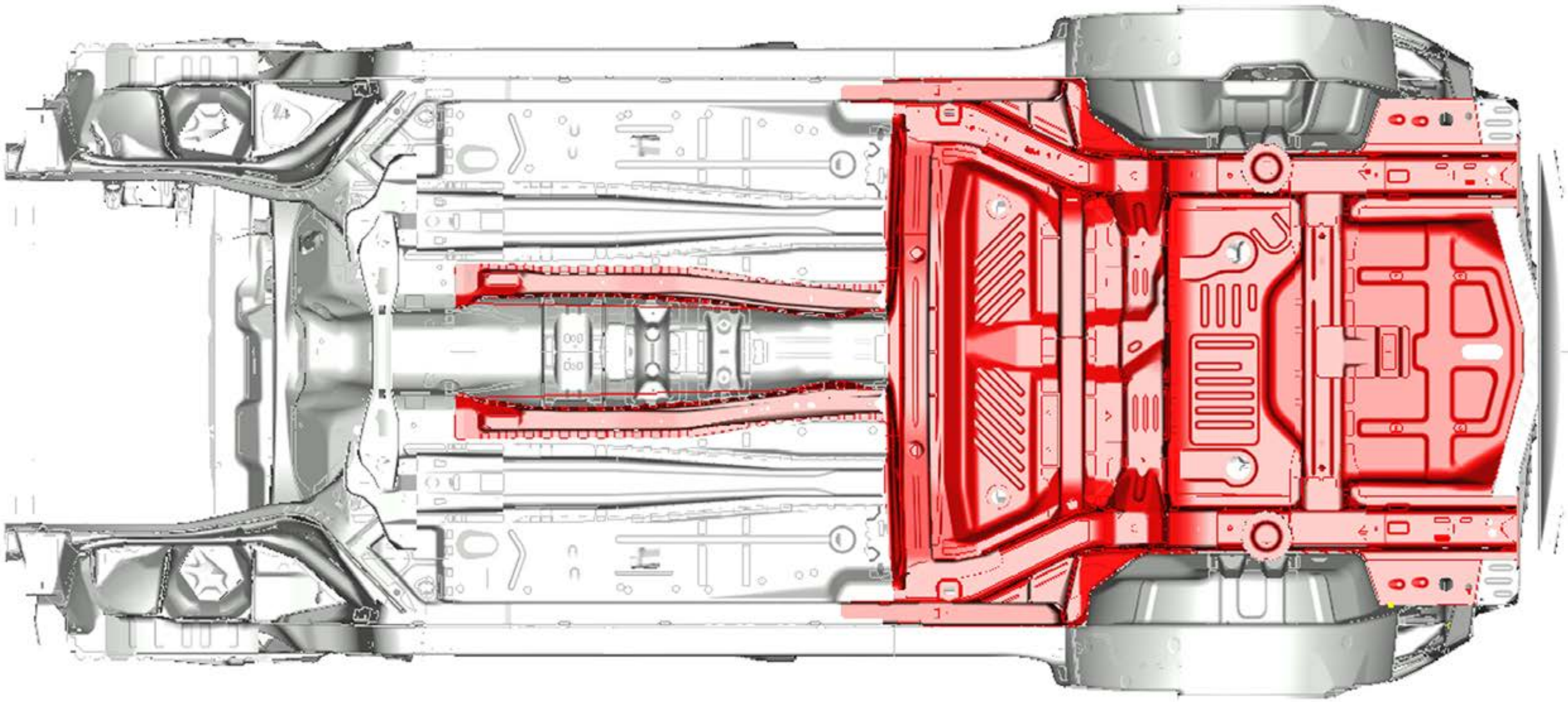
Agenda

- Background
- Material Usage
- Design Approach
- Functional Performance
  - Static Stiffness
  - Dynamic Stiffness
  - Safety

BACK GROUND

CD Derivatives

Platform Changes



- Shock Tower revised to accommodate new stance requirements
- Tunnel Runners modified for increased load capacity
- Rear Floor assembly completely redesigned to account for SUV functionality

Global Footprint

★ **Engineering:** Dearborn

★ **Manufacturing:** Oakville, Ontario – with export to Europe and Asia

MATERIAL USAGE

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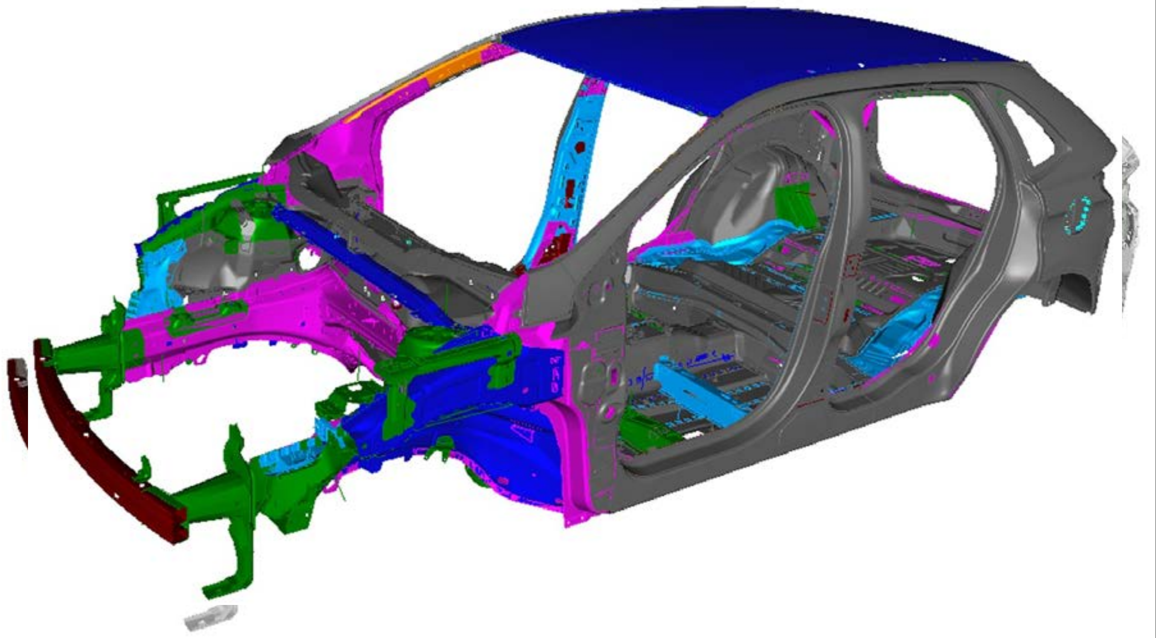
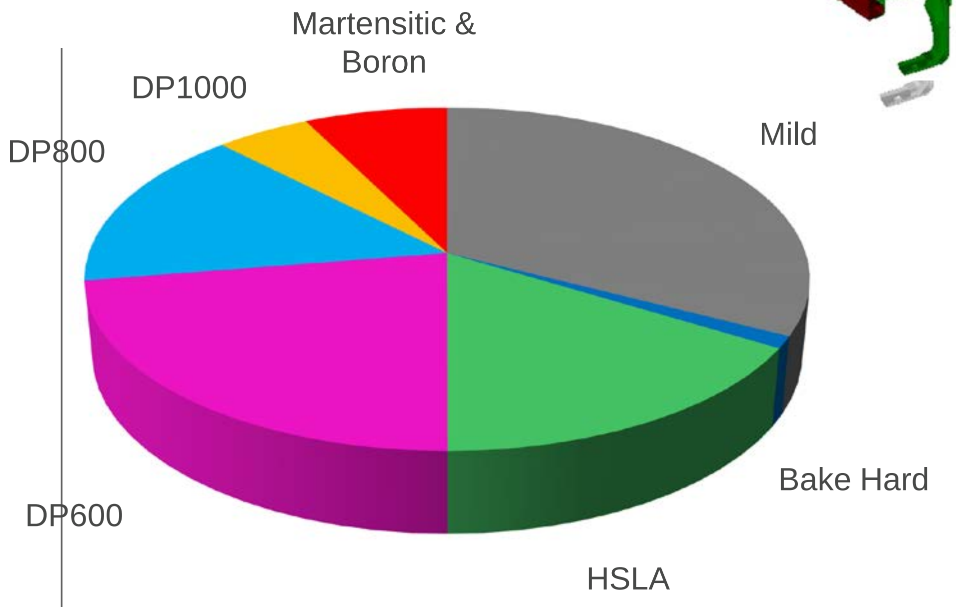
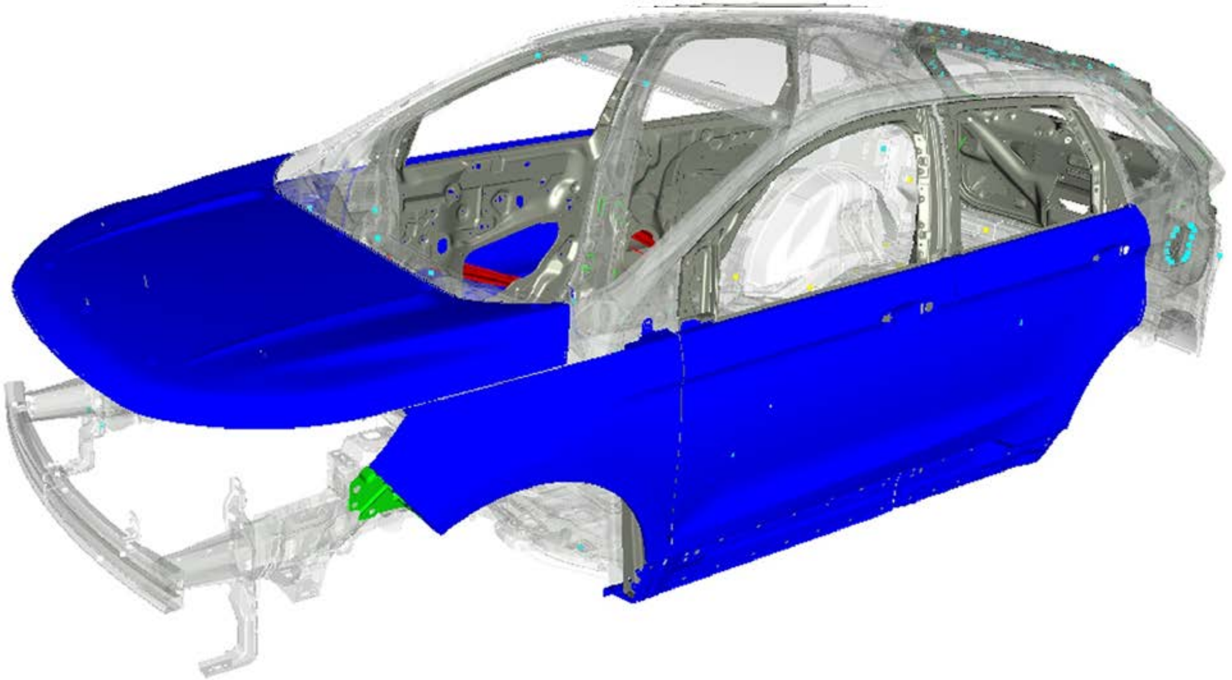
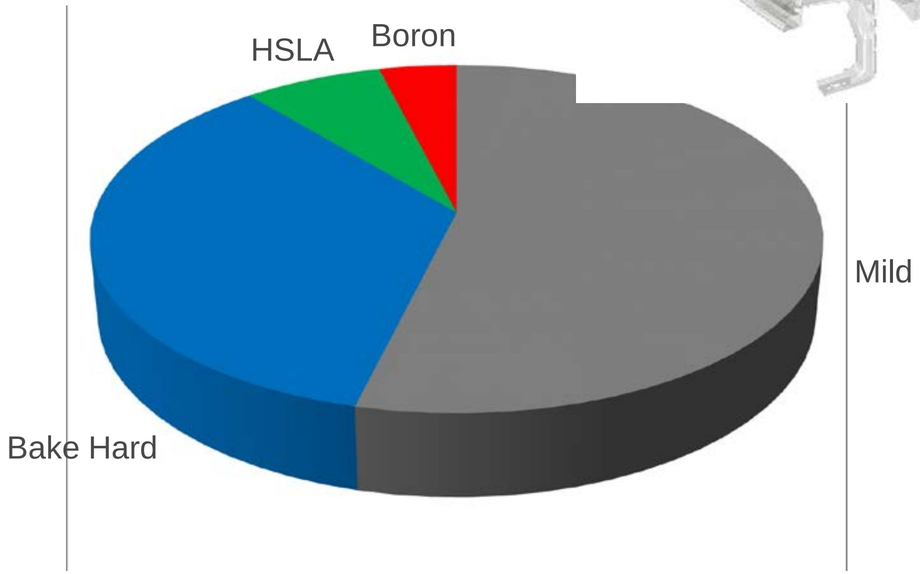
BIW Materials





Closures Materials



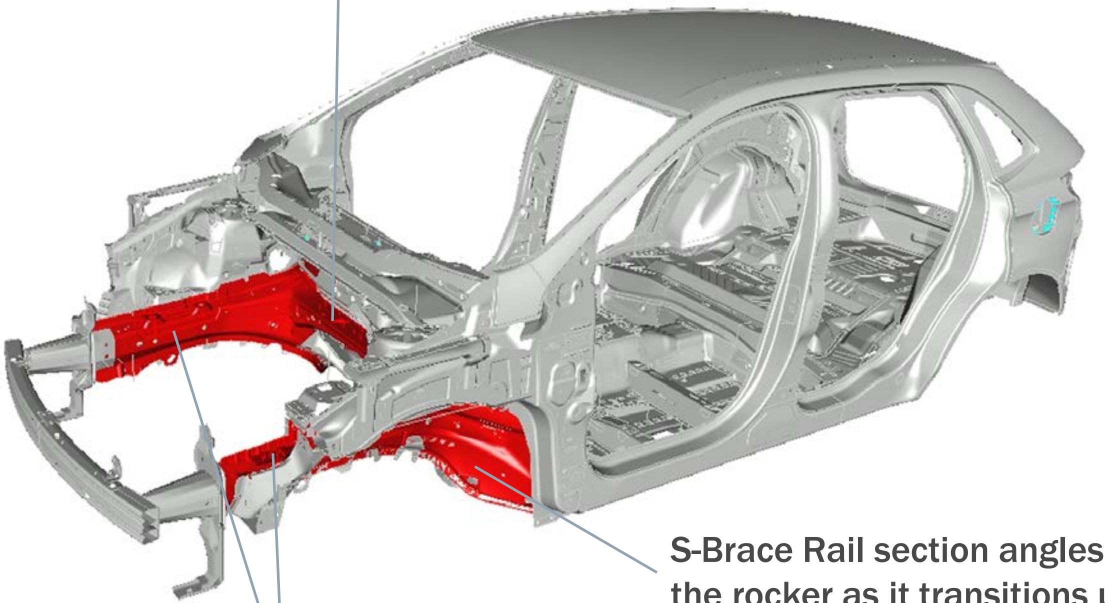


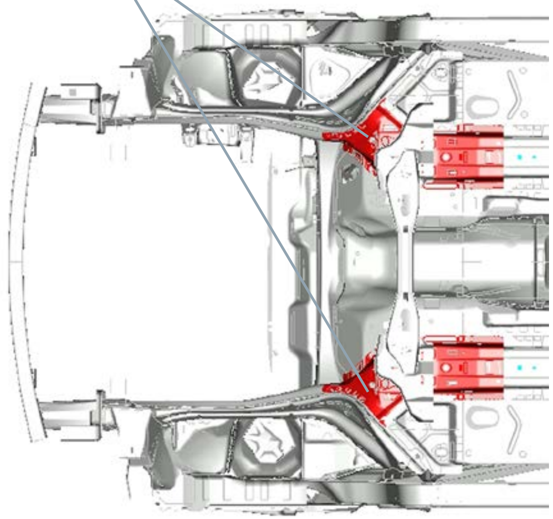
DESIGN APPROACH

Front Structure Design

Dash Cross Member acts as a compression member during loading to stabilize the Front Rail

Y-Brace replaces the typical Torque Box to distribute load to the rocker and the sled runners

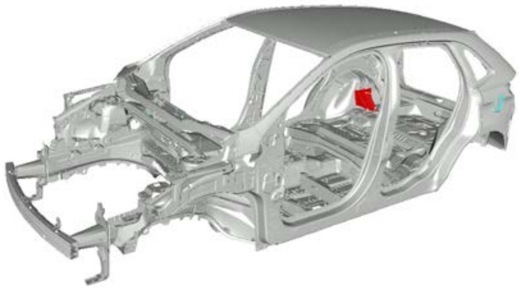




S-Brace Rail section angles toward the rocker as it transitions under the dash for improved load path

Hexagonal Front Rail section for improved axial crush performance allowing for the use of lower gages

Rear Under Body – Lion's Foot



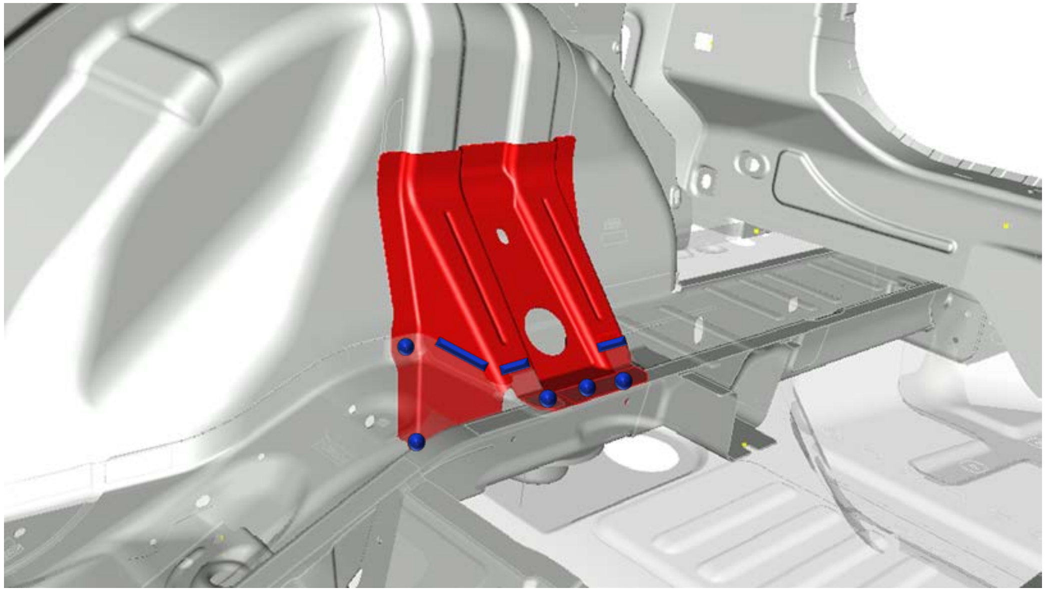
Typical "lions foot" set on pan and joined to rail section only at the weld flanges.

Utilized design developed for the Fusion.

Integrated into the rail section for optimal load transfer to improve joint stiffness – elimination of flange flex

Improved joint contributed to a 7.5% improvement in BIW torsional stiffness.

Local and equivalent stiffness for Subframe and Shock attachments
were increased.



Rear Rails

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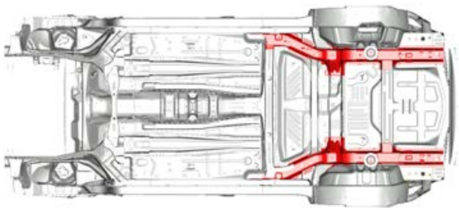
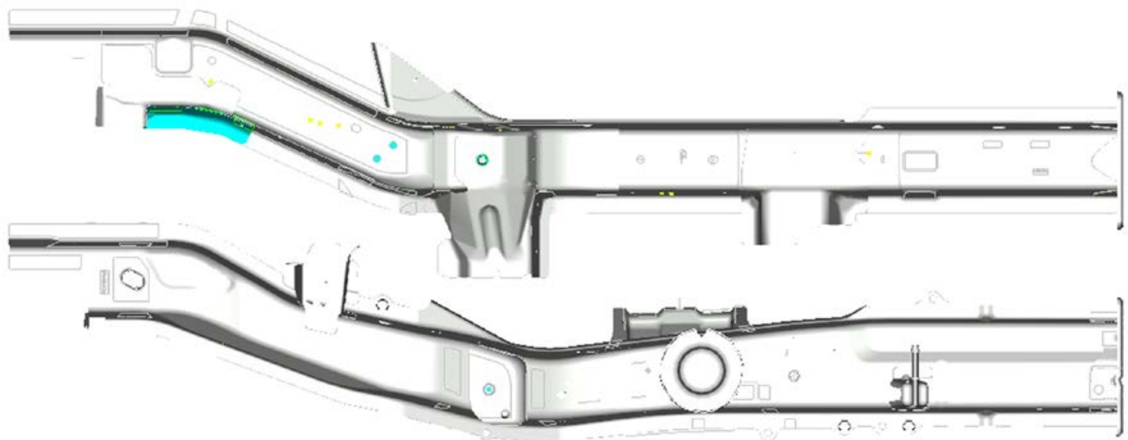


Plan View

2015 Edge

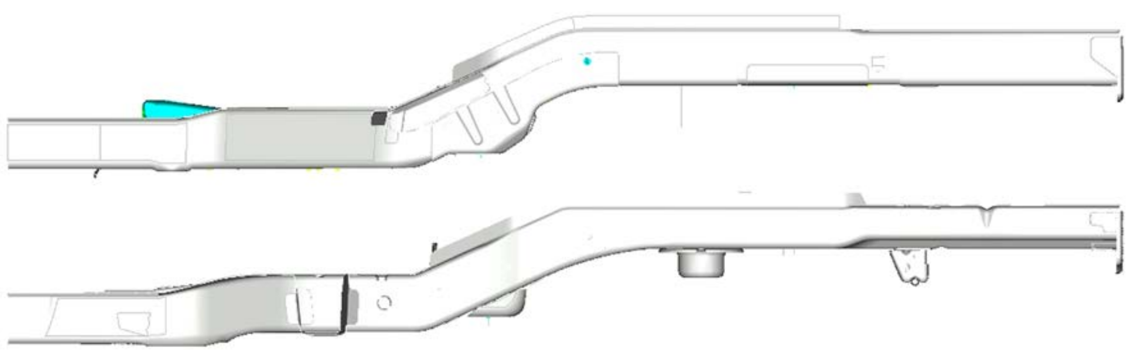
2014 Fusion



Side View

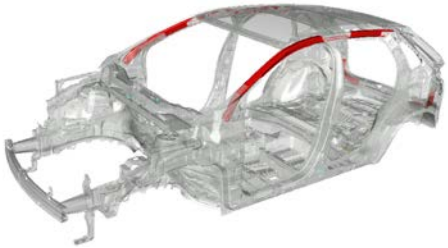
2015 Edge

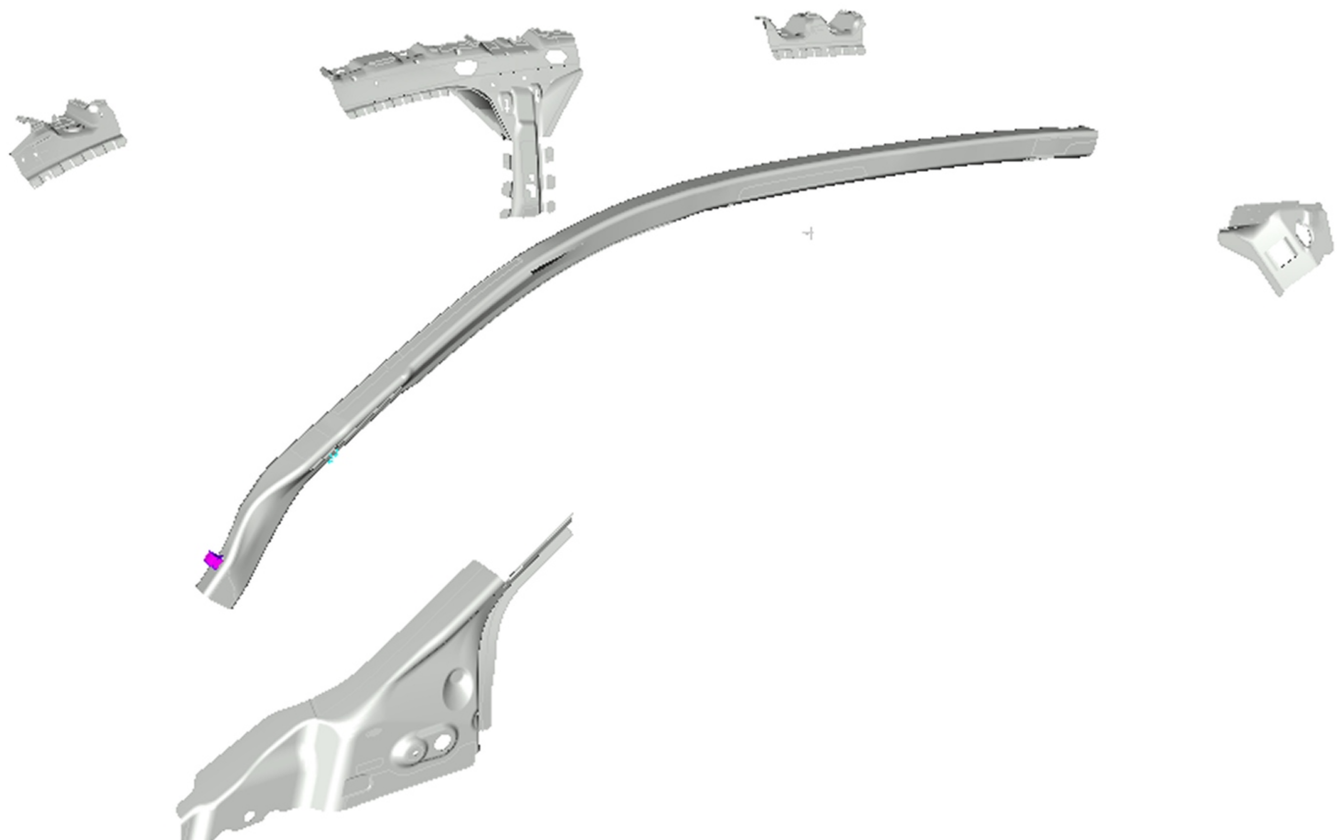
2014 Fusion



Rail efficiency increased through geometry refinement

Hydro-Form Components





D-Pillar Hydro-Form

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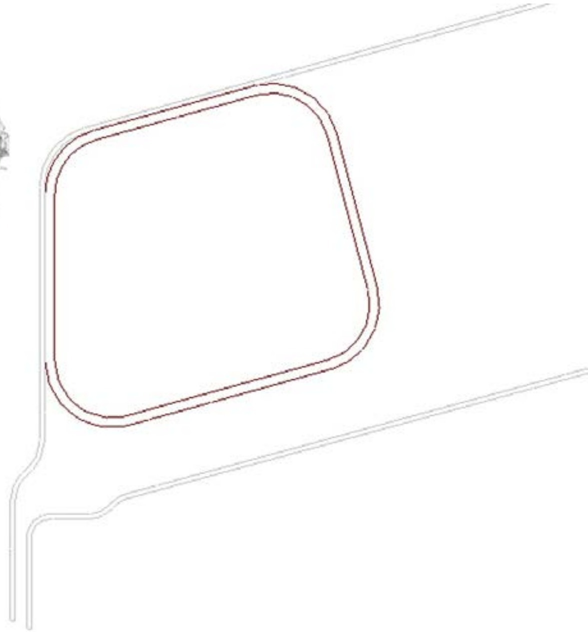
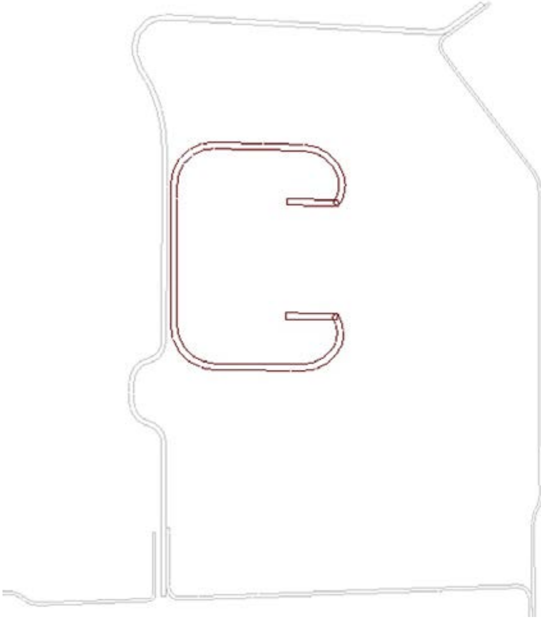
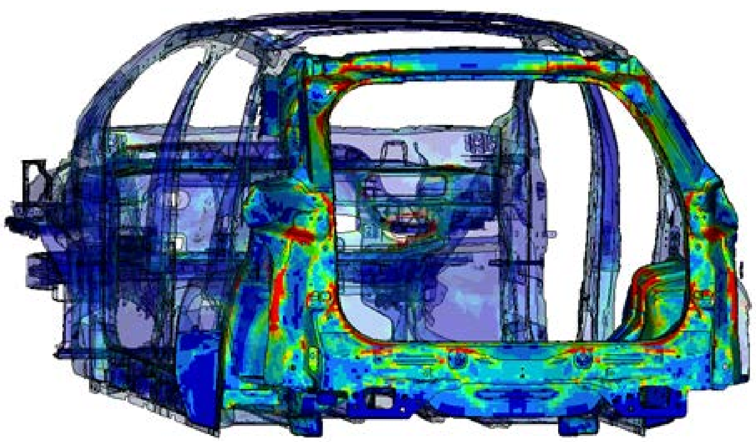
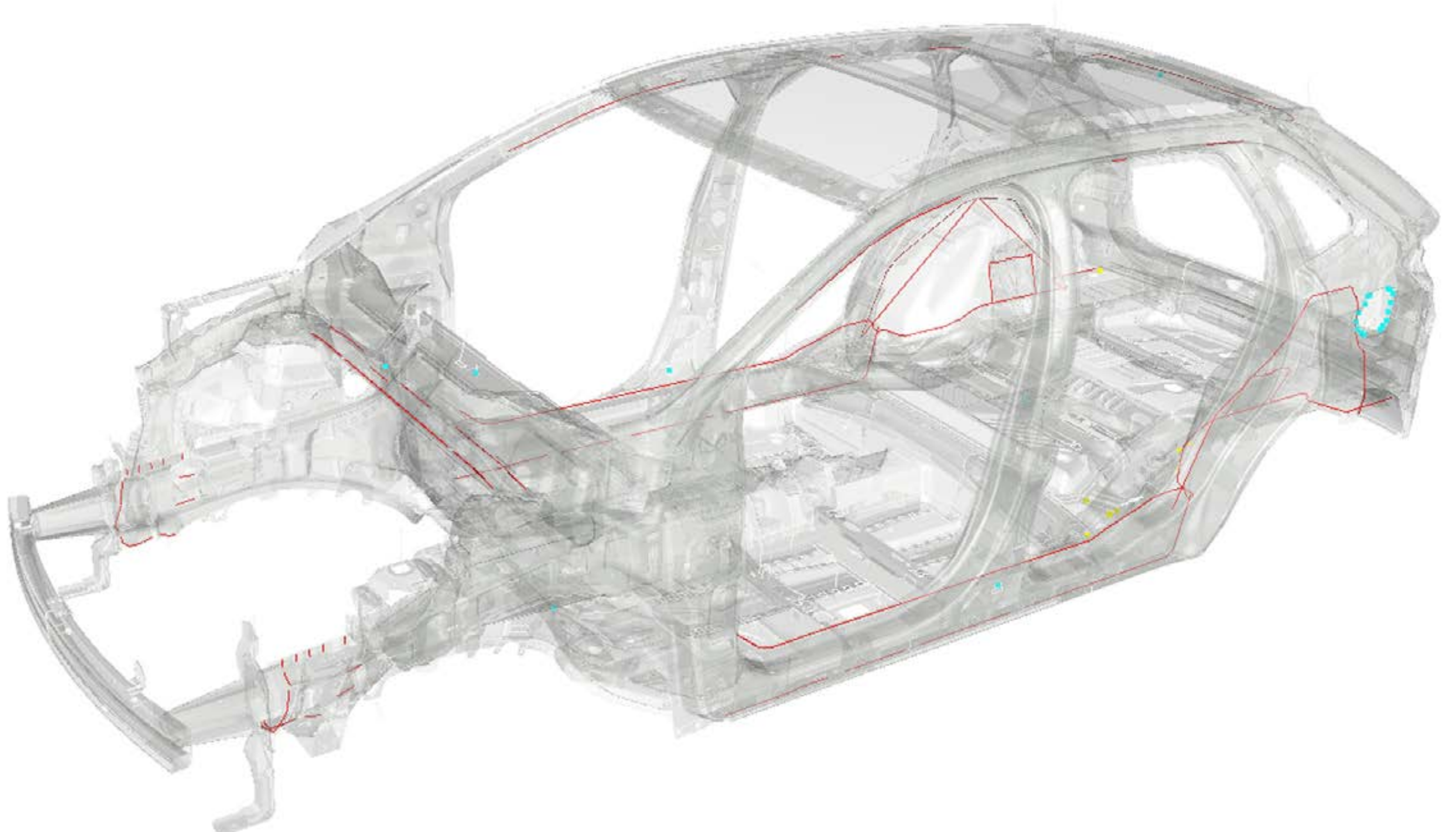




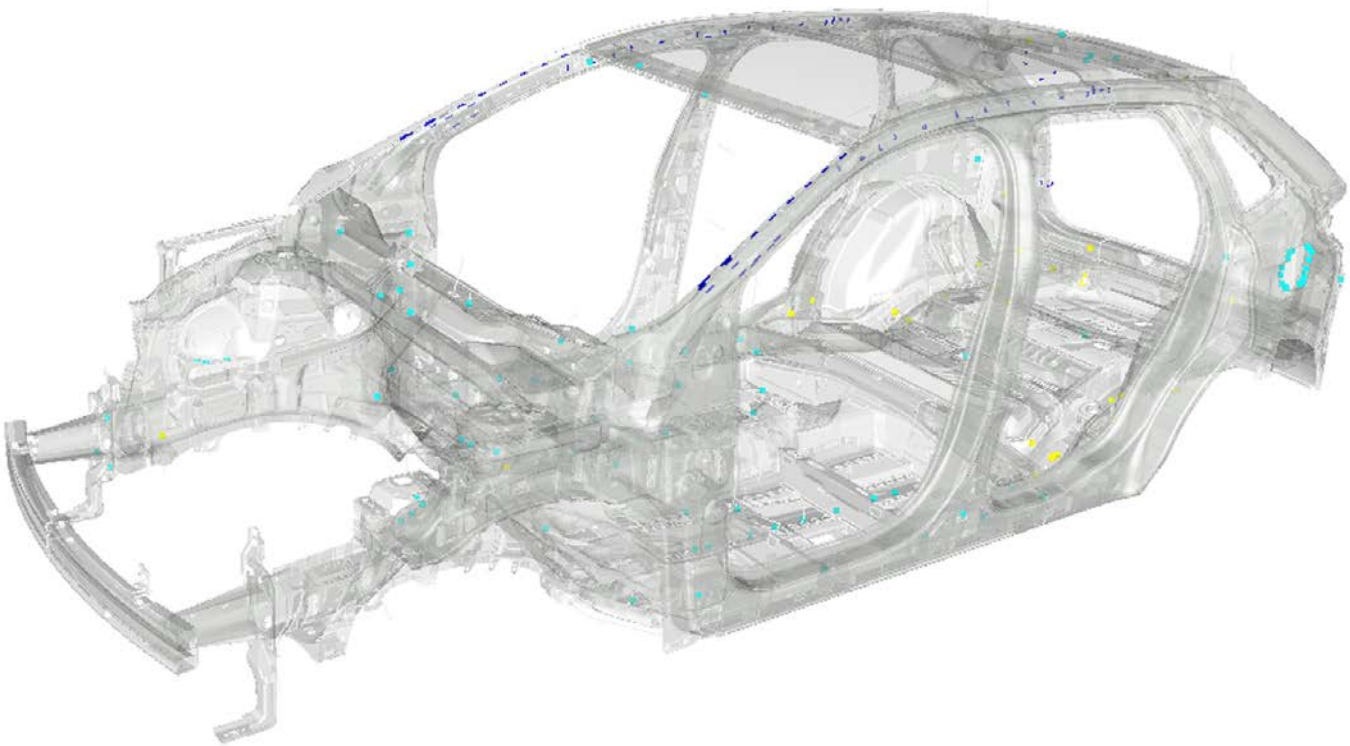


Joining - Adhesive



- Over 25 meters of adhesive in the BIW primarily in the platform
- Added between Body Side Outer and the Hydro-Form A-Pillar / Roof Rail to augment welding
- Primary usage is in the Under Body to improve BIW stiffness

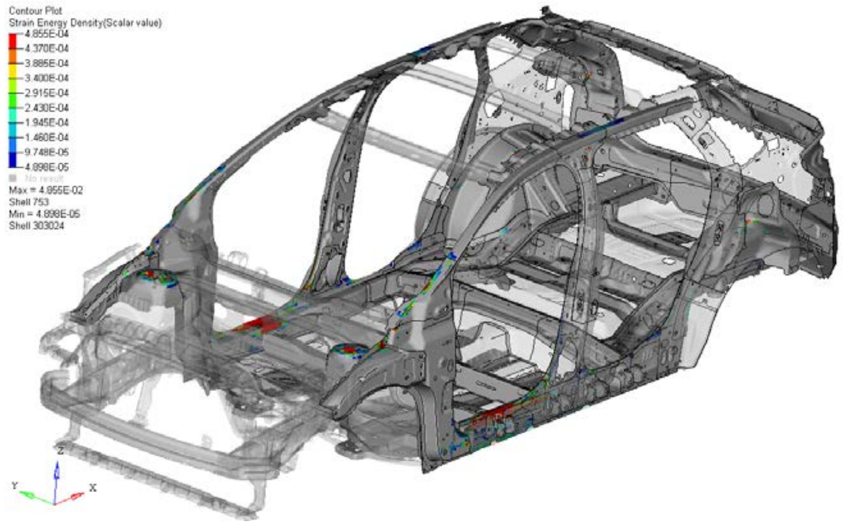
Joining - Welding

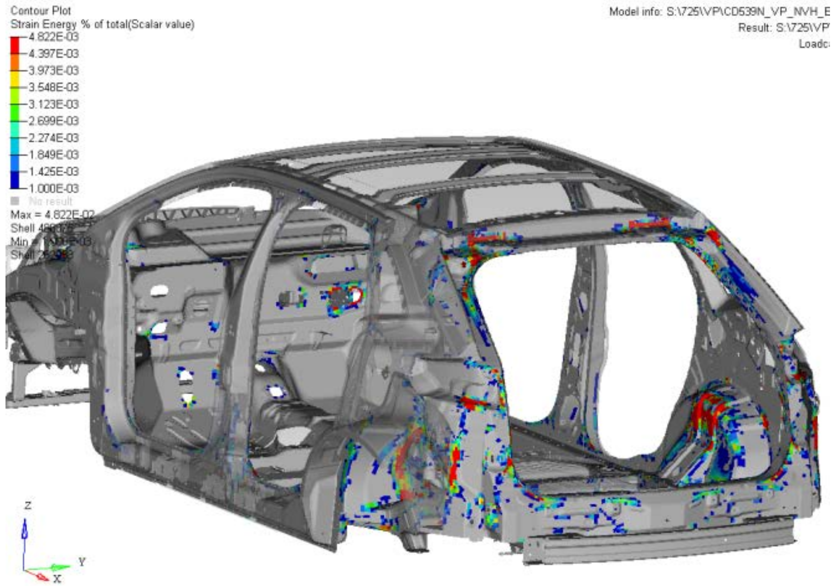


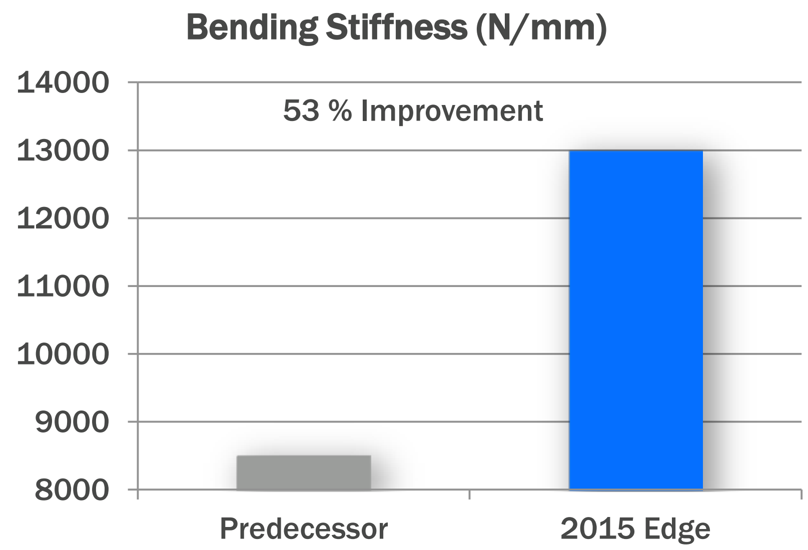
- 3.6 meters of laser braze to join the Roof to the Body Side
- A combination of 66 stitch and C-Shaped welds used in the Body Side build
- In addition, the following conventional joints are use:
    - 4800 resistance spot welds
    - 55 gas metal arc welds
    - 192 projection weld nuts
    - 131 weld studs

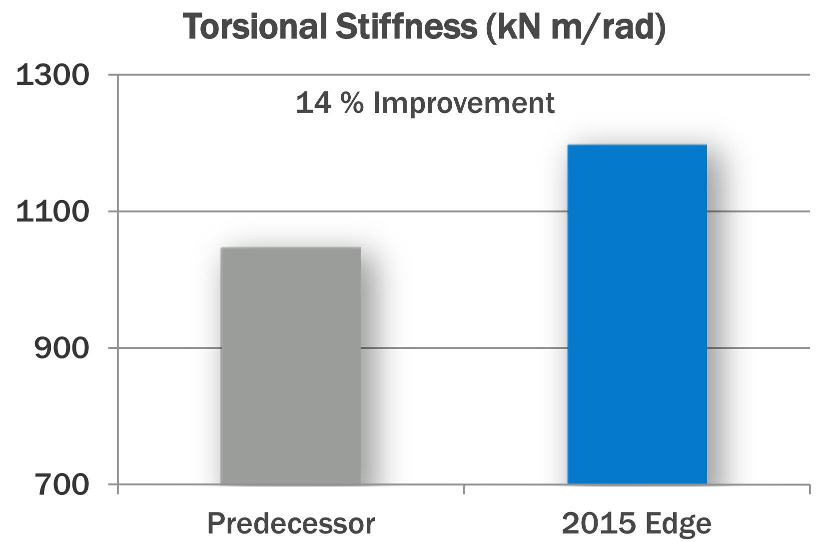
FUNCTIONAL PERFORMANCE

Static Stiffness

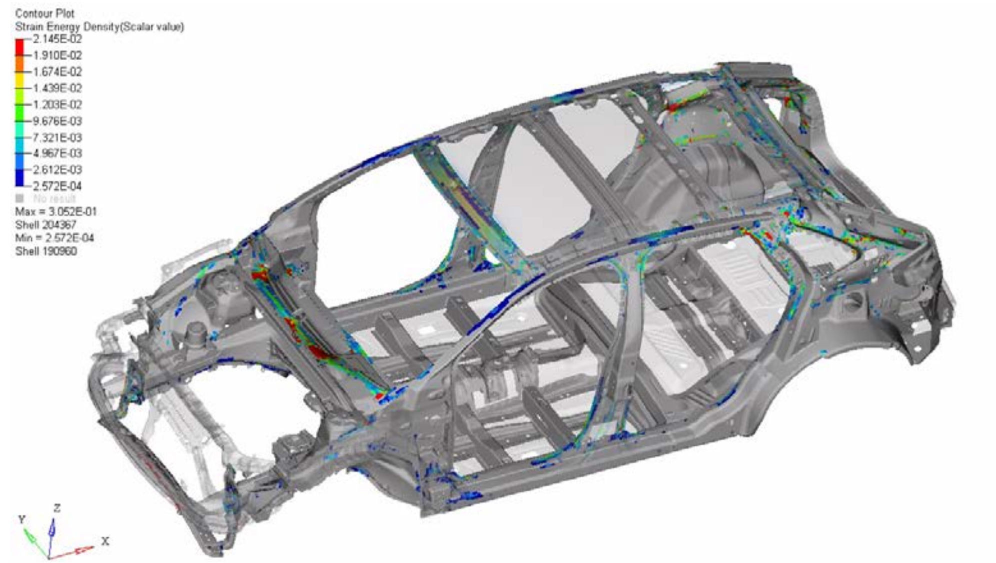


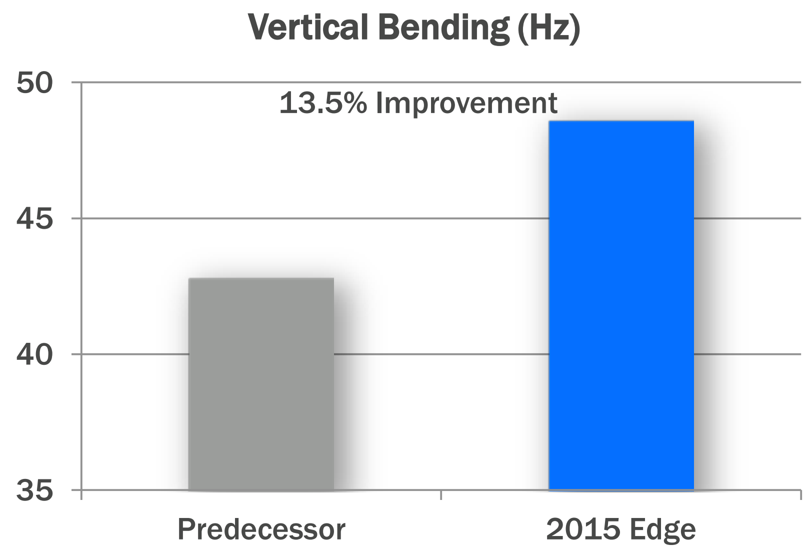


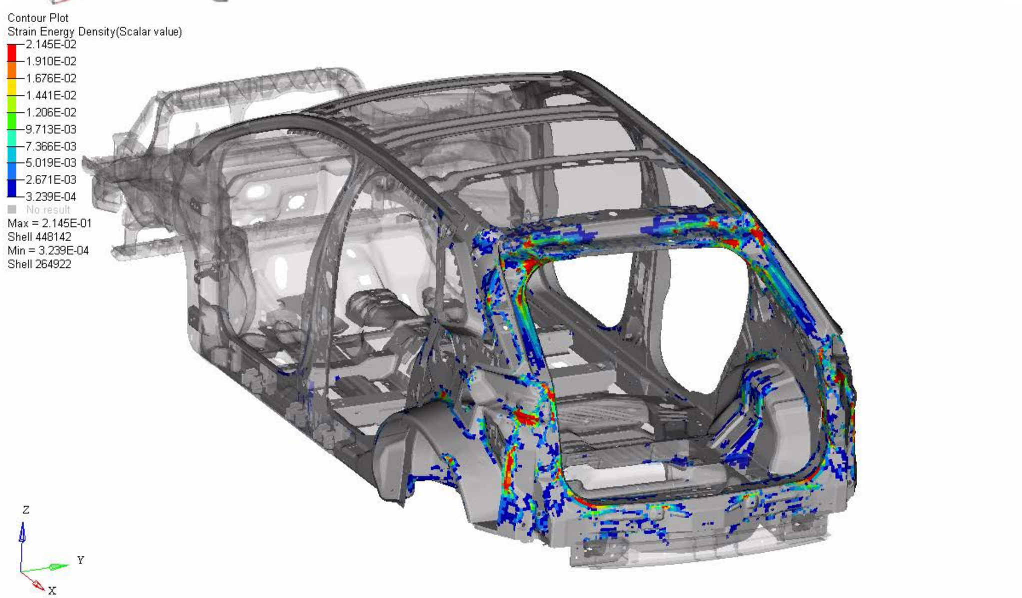


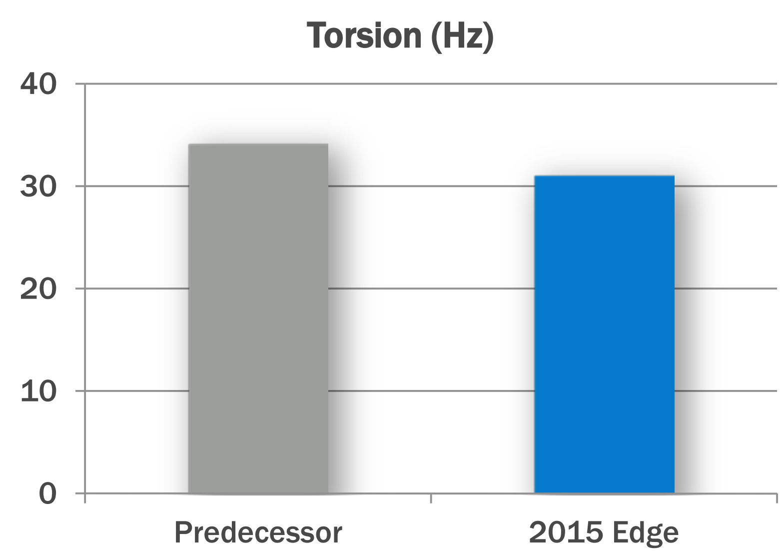


BIP Dynamic Stiffness





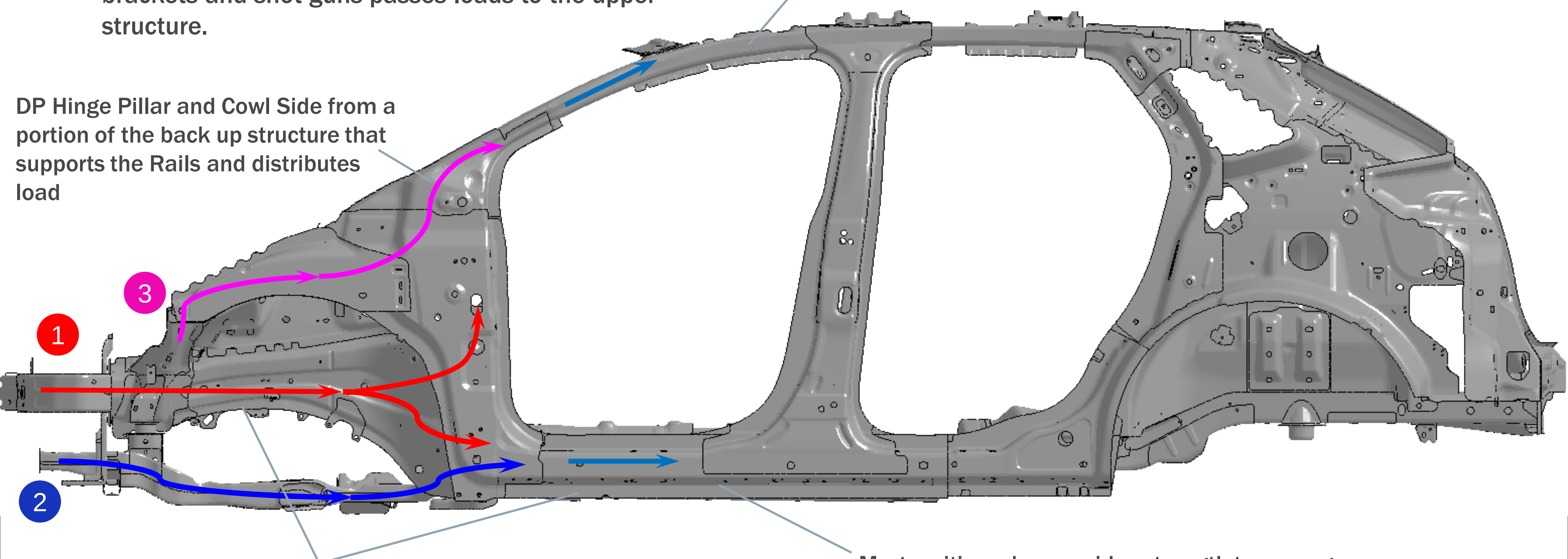




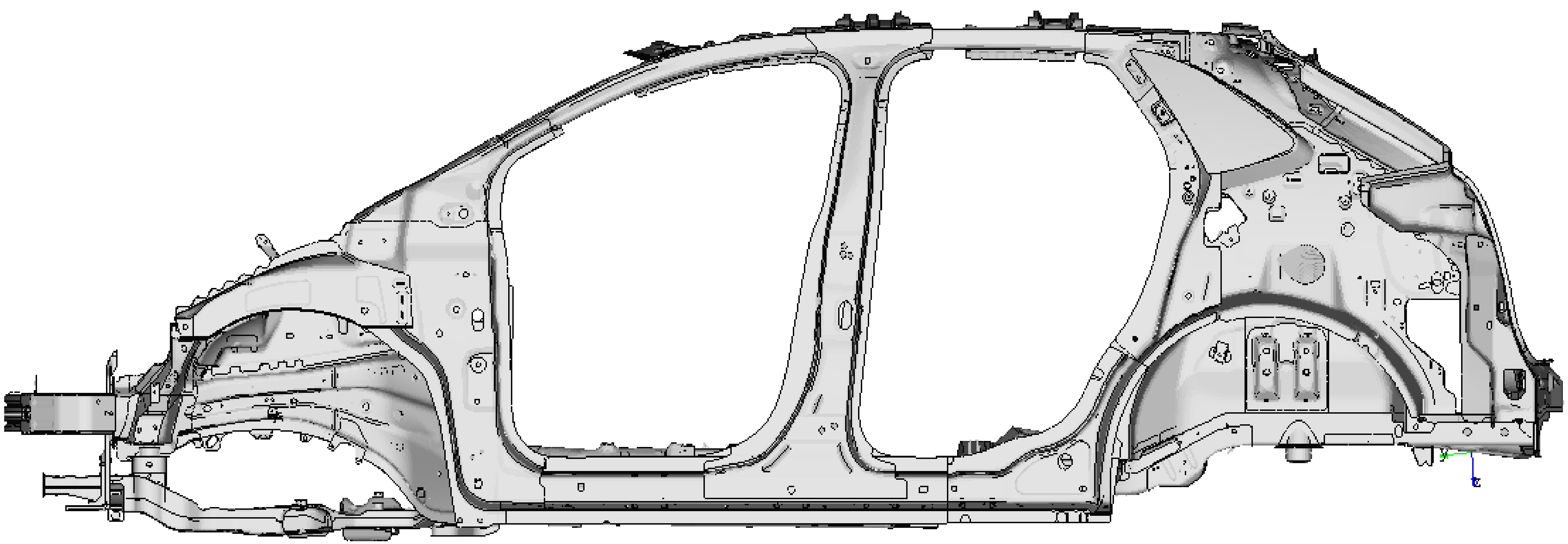
Load Path – Front Structure

Structure utilizes a three load path strategy:

1. Primary crash loads are taken by the front crush cans and front rails. The swept rail design distributes the loads to the sled runners, tunnel runners, hinge pillars, and rockers.
2. The sub-frame provides a lower load path that directs load to the sled runners, tunnel runners, and rockers.
3. The upper load path through the point mobility brackets and shot guns passes loads to the upper structure.



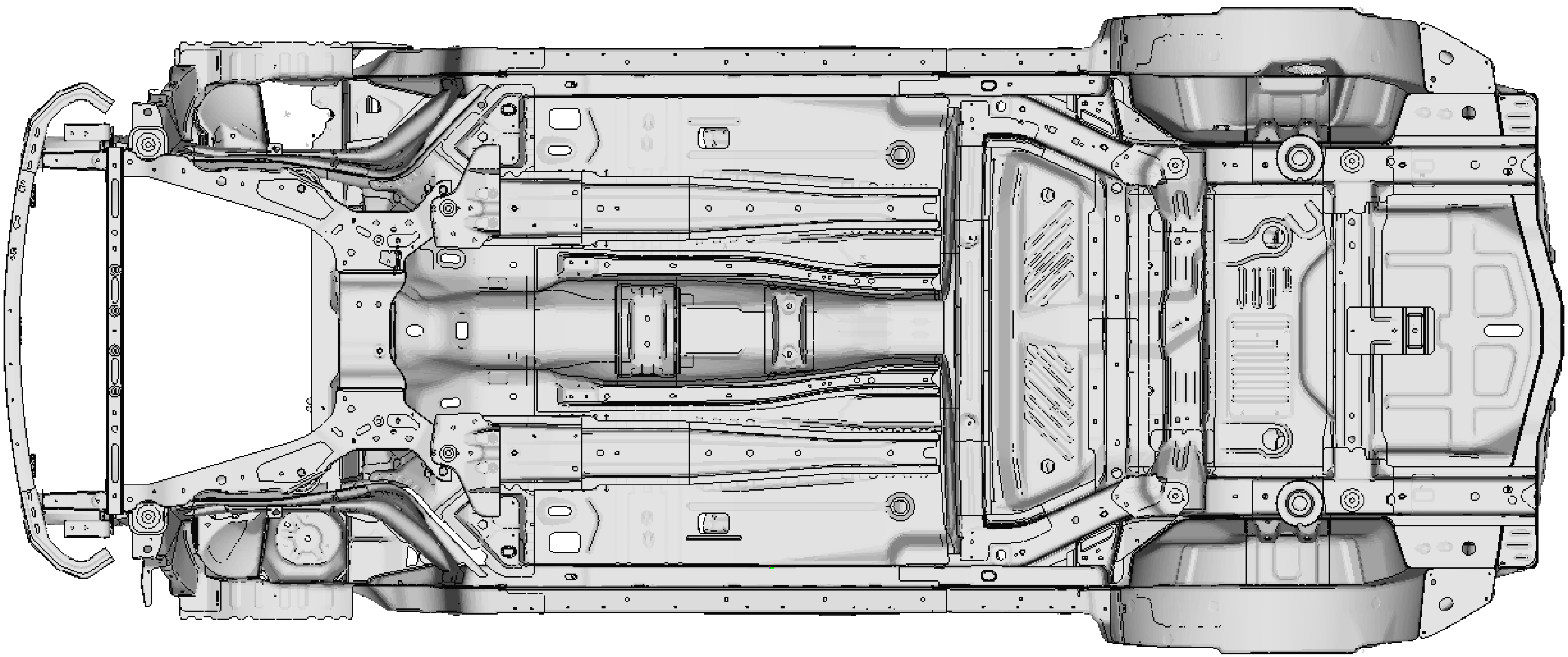
Frontal Impact (Side View)



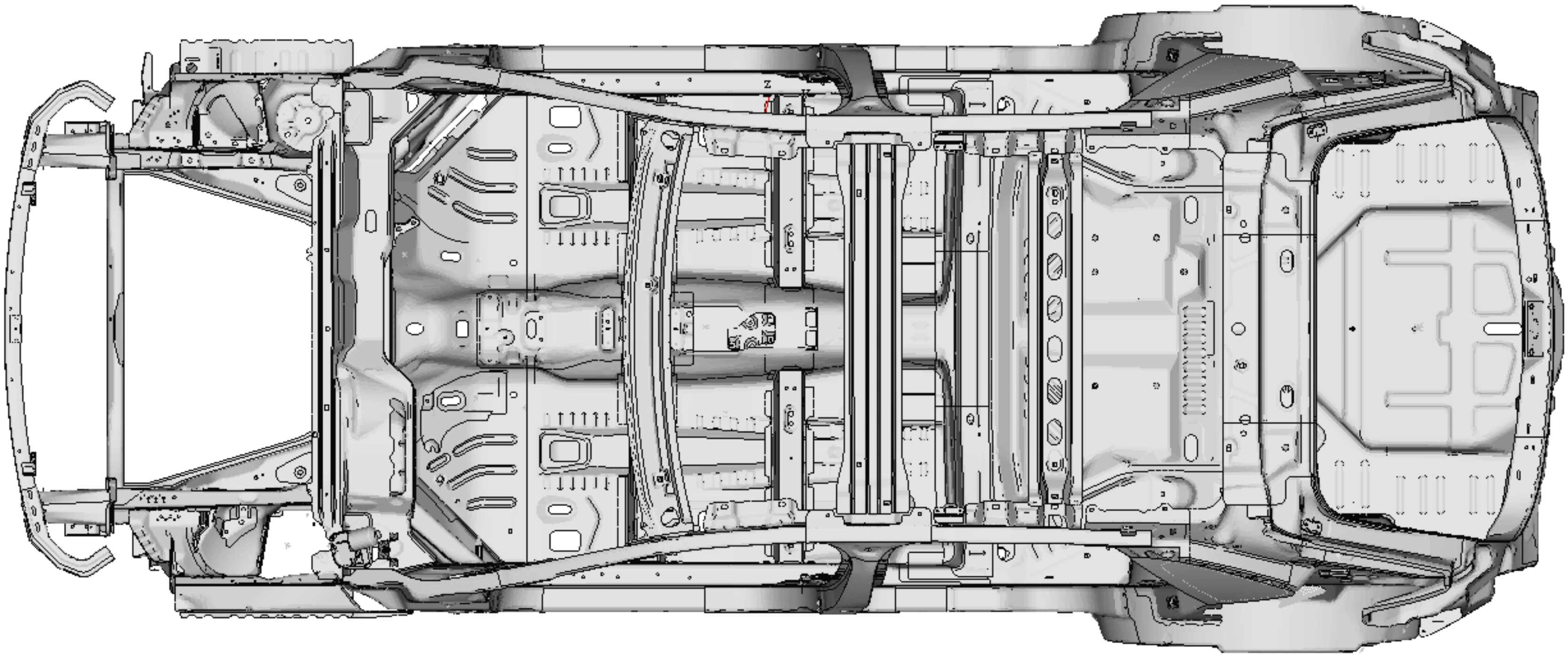
- Bumper system Crush Cans and Front Rails absorb most of crash energy.
- Loads are also balanced by the sub-frame, rails, and shotguns

Offset Impact (Bottom view)

Dash and Floor intrusions are limited due to the performance off the front rail and sub-frame



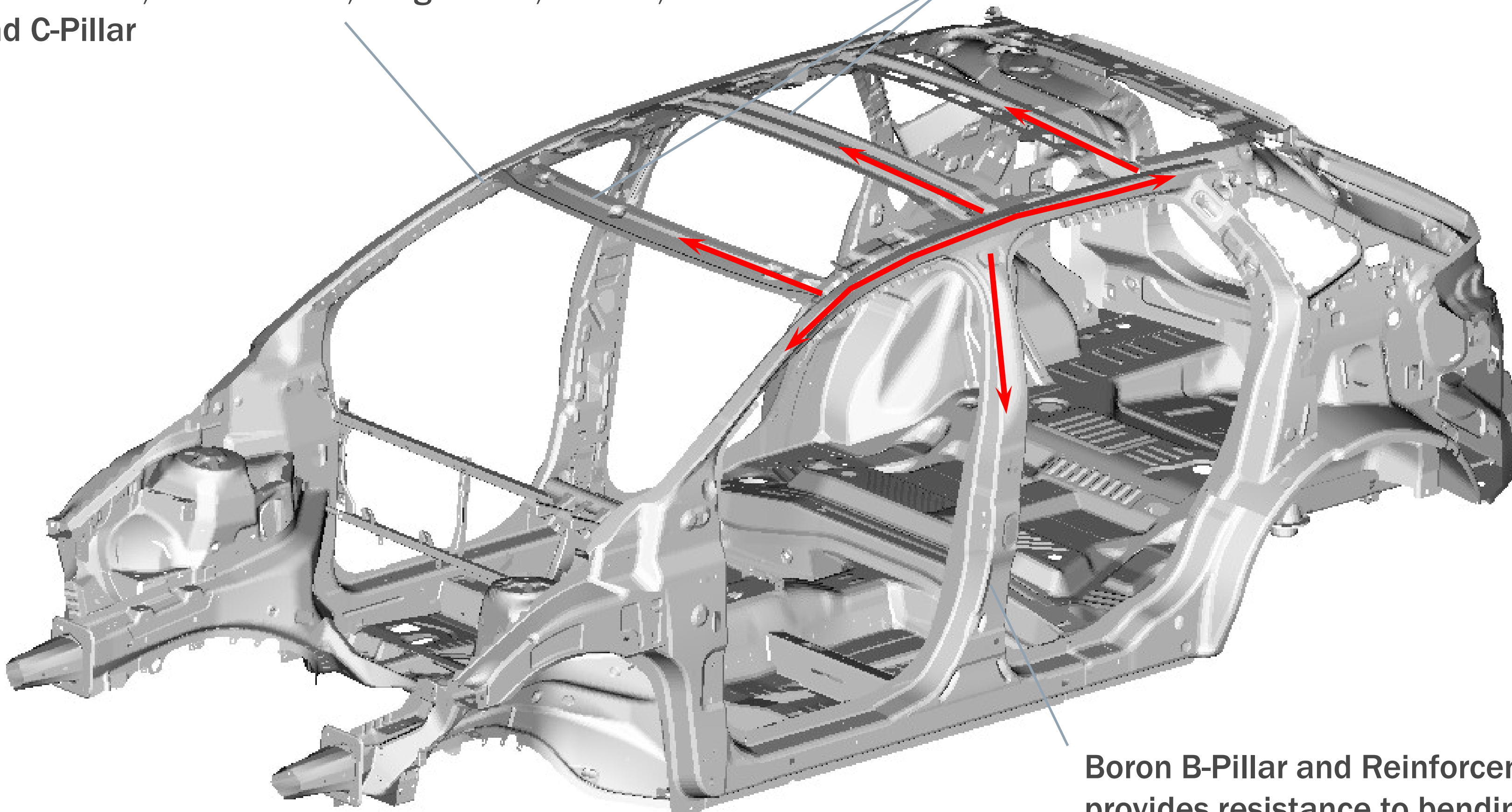
Offset Impact (Top view)



Roof Strength Load Path

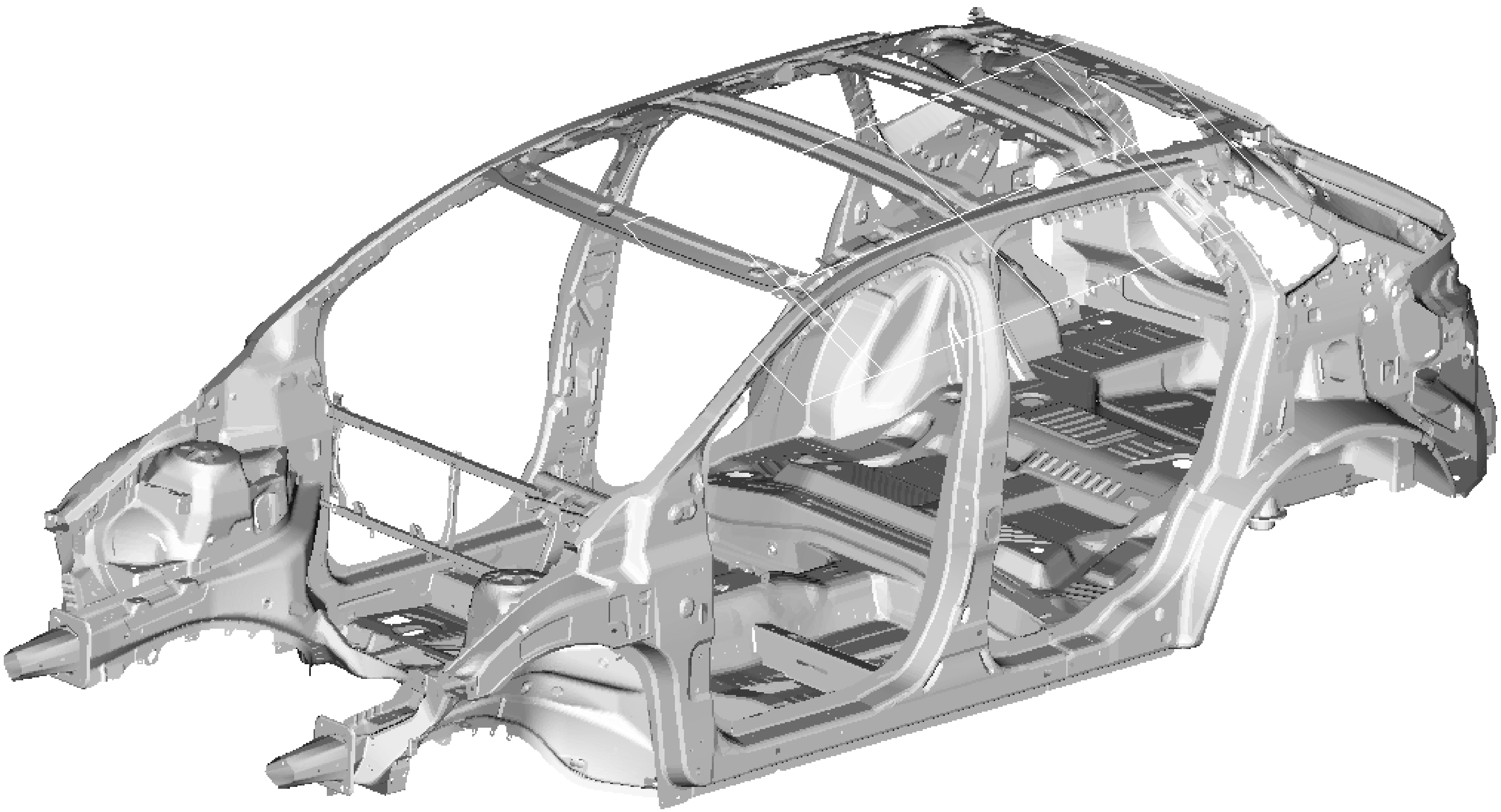
DP1000 Hydro-formed roof rail distributes load to Roof bow, Front header, Hinge Pillar, B-Pillar, and C-Pillar

DP800 in the Roof Structure provide a stable load path to the opposite side structure



Boron B-Pillar and Reinforcement provides resistance to bending due to lateral and axial loads

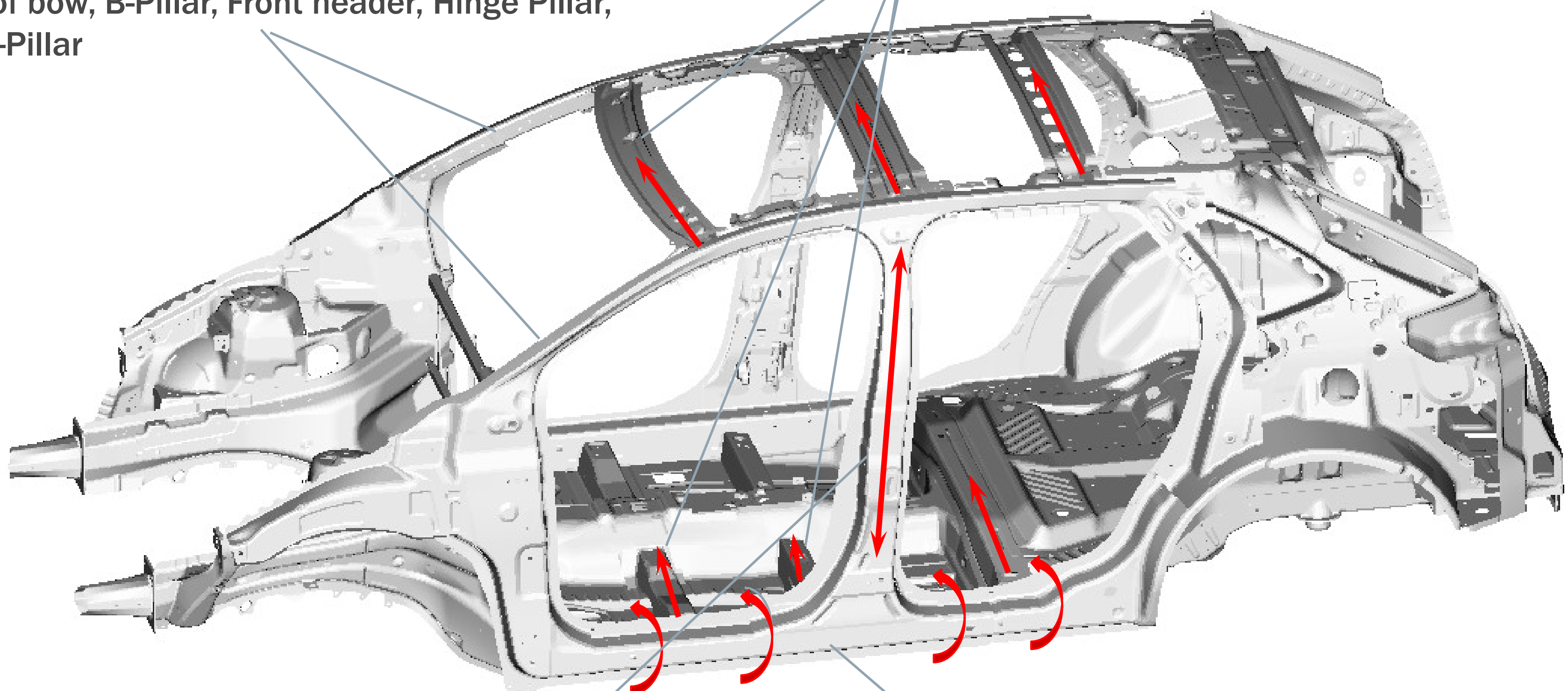
Roof Strength Animation



Side Impact Load Path

DP Floor Cross Members and Roof Bow, and Headers provide lateral load path

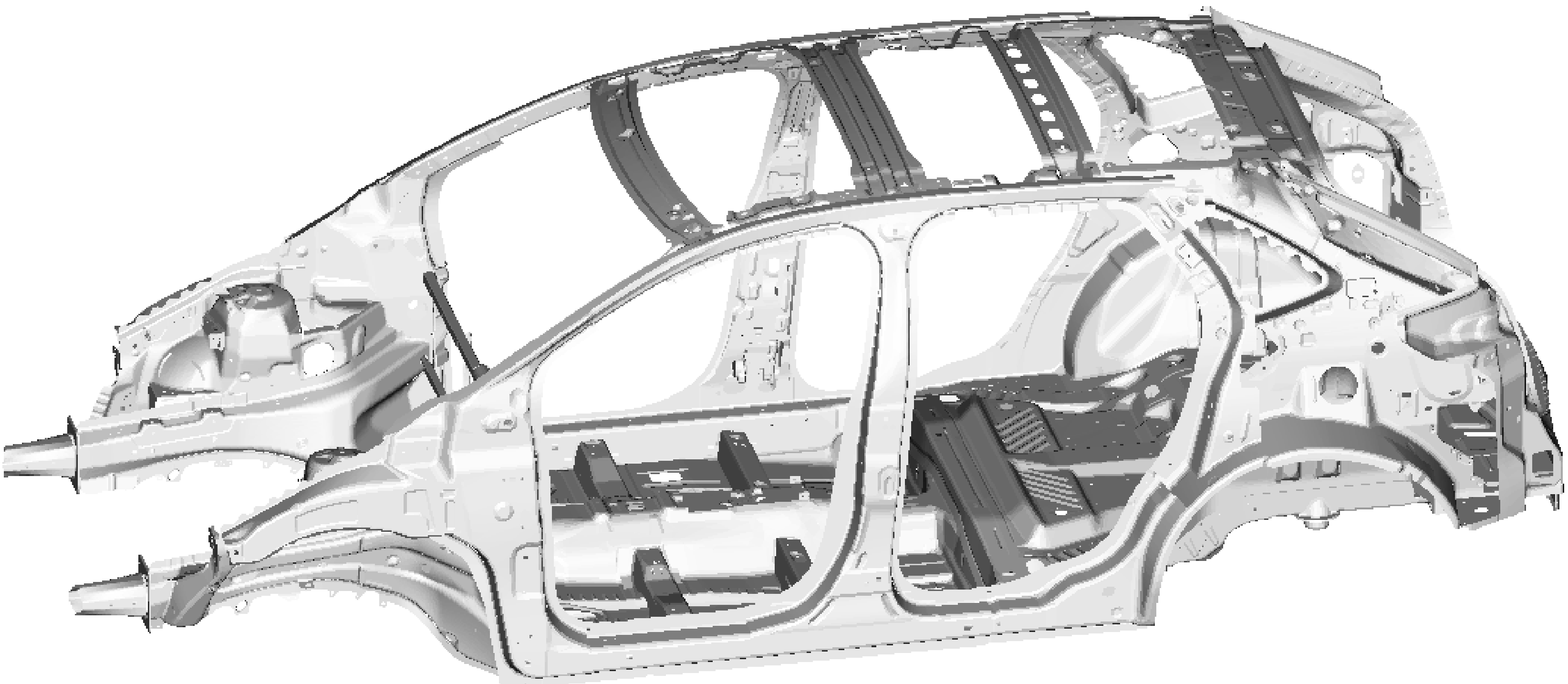
DP1000 Hydro-formed Roof rail distributes load to Roof bow, B-Pillar, Front header, Hinge Pillar, and C-Pillar



Boron B-Pillar provides resistance to buckling due to lateral loads and distributes load to the Roof Rail and Rocker

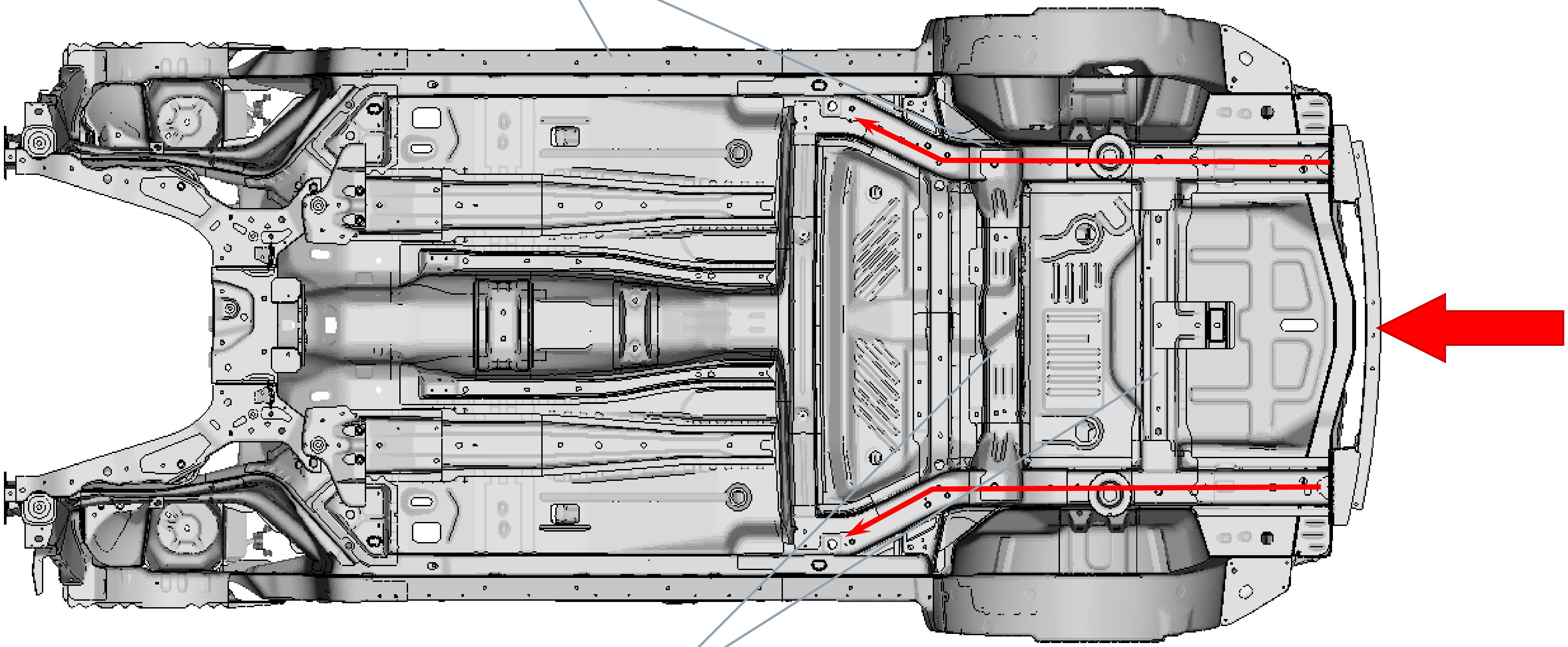
Martensitic Rocker provides torsion stiffness and transverse load distribution

Side Impact Animation



Rear Impact

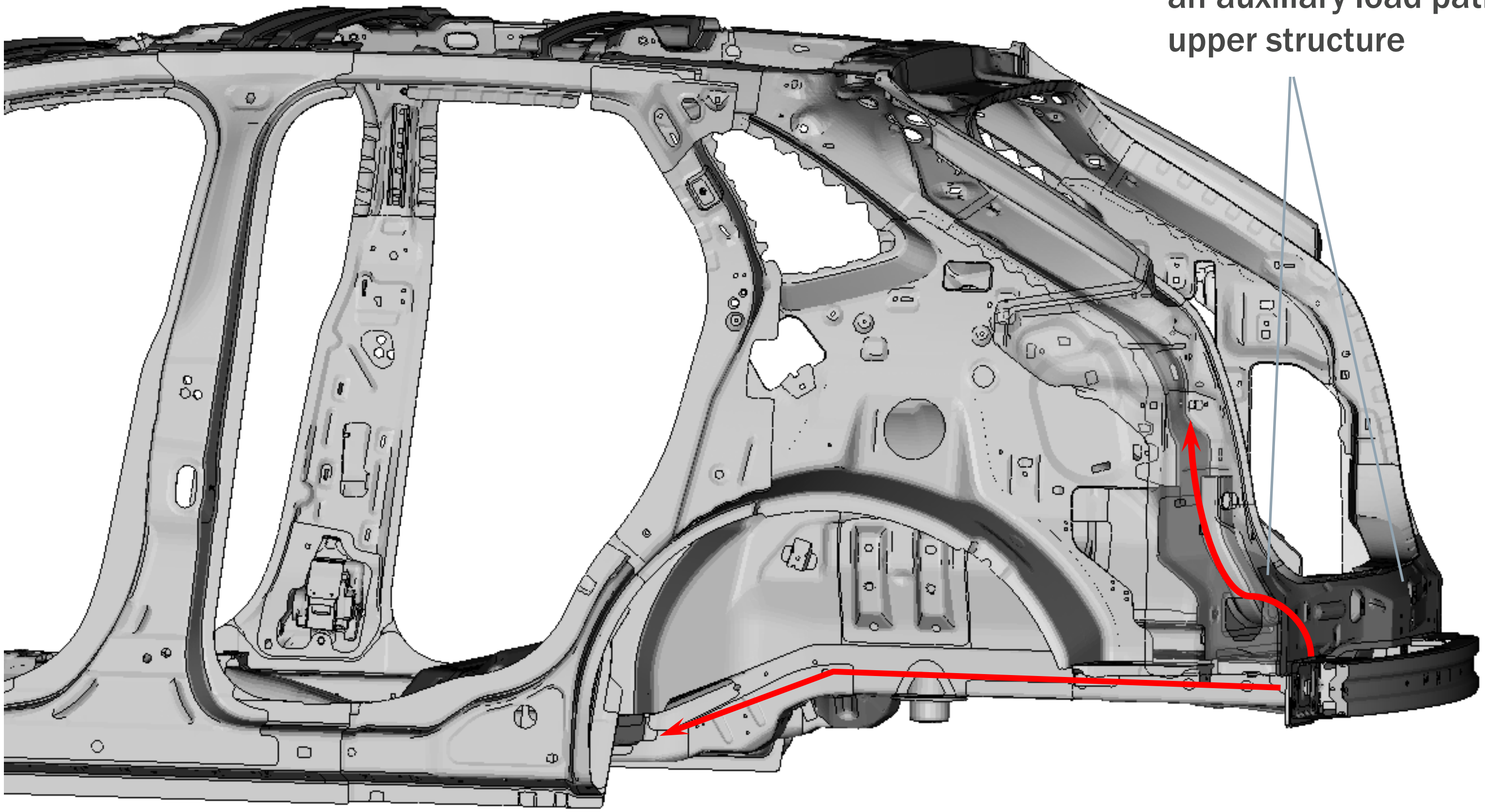
Primary load is through the DP800 Rear Rails and into the Rocker



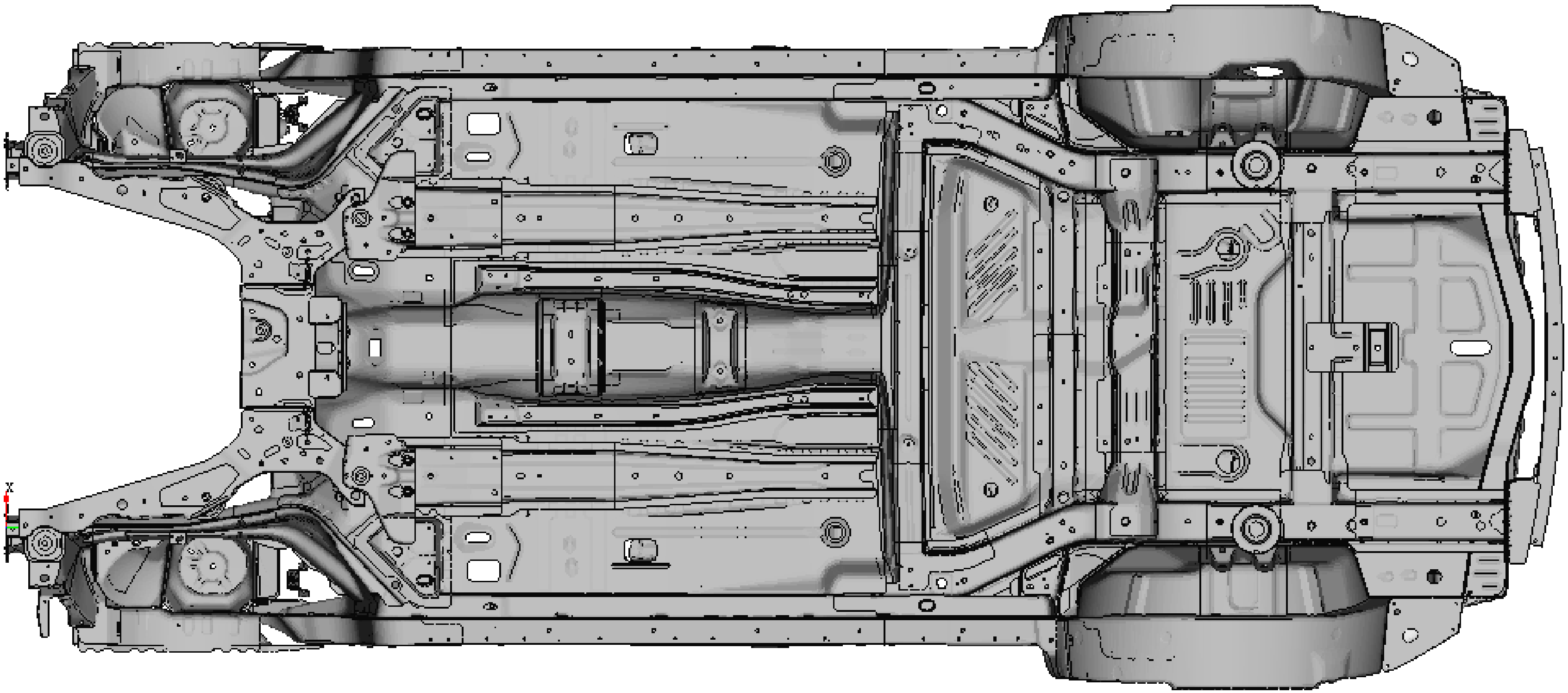
HSLA and DP600 Cross Members and Reinforcements provide resistance to Rail buckling due to axial loading.

Rear Impact

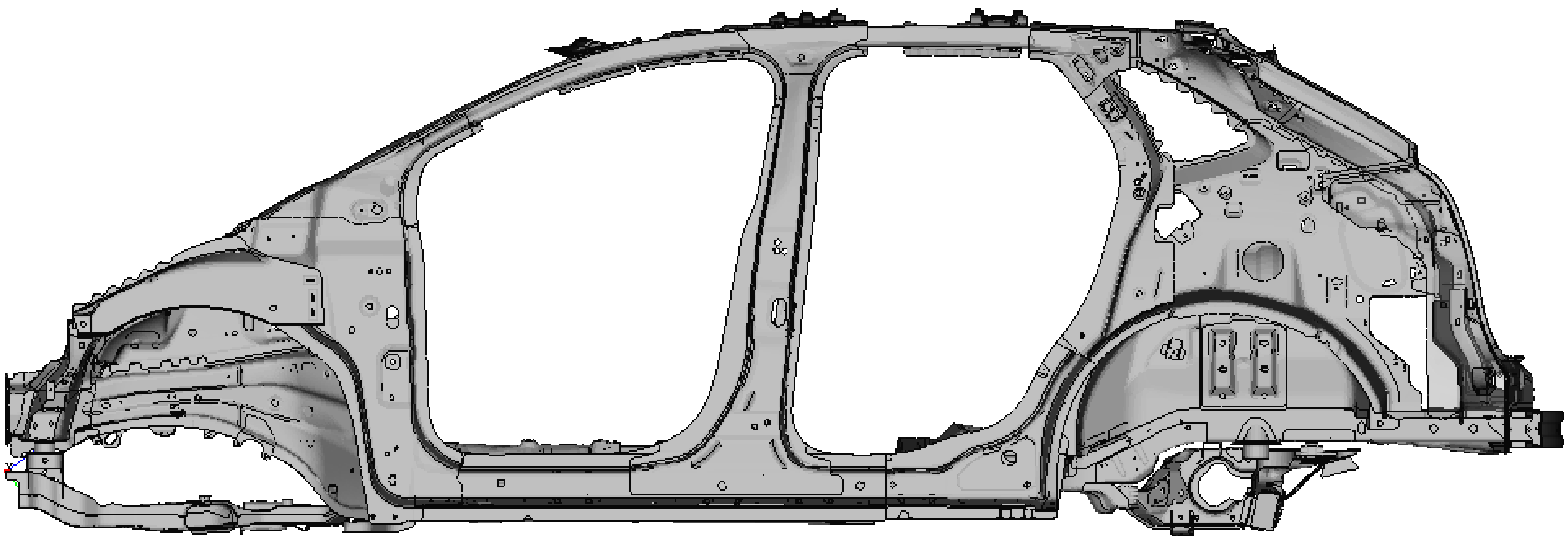
Hydro-formed tubes provide an auxiliary load path to upper structure



CD539N – Rear Impact



CD539N – Rear Impact



Crash energy is absorbed by the rails protecting the fuel tank area from undesirable intrusion.

Thank You for Your Attention

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Steel Market Development Institute

Presentations will be available May 18 at www.autosteel.org

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